PUMA HT / QL series

Twin Spindle Turning Center & Gantry Loader series

Doosan Machine Tools

Optimal Solutions for the Future

Two Spindle, 4-axes Turning Center
Realizes Twice the Productivity

PUMA HT230T / H250T / H310T
PUMA H250TM / H310TM

Integral CNC Gantry Loader Ensures Versatile Automation and High Productivity

PUMA HT230TG/QL200H/QL300H
PUMA QL200HM/QL300HM

Main Spindle

Main spindle is supported by high precision bearing combination with large diameter. All spindle bearing are lubricated by grease.

C-axis contouring provides main spindle positioning in increments of 0.001degree. Three dimensional contouring, complex round and prismatic machining, square shoulder and lettering are accomplished by synchronizing the spindle with linear axes (on H250TM / H310TM / QL200HM / QL300HM)

PUMA HT230T / HT230TG series (6"class)

Max. spindle speed	Motor (15/30min)
4500 r/min	11/7.5 kW (14.8/10.1 Hp)

PUMA H250T / QL200H series (8"class)

Max. spindle speed	Motor (30min)
4500 r/min	11 kW (14.8 Hp)

PUMA H310T / QL300H series (10"class)

Max. spindle speed	Motor (30min)
3500 r/min	18.5 kW (24.8 Hp)

C-axis control of main spindle

C-axis index

360° (in 0.001°increment)

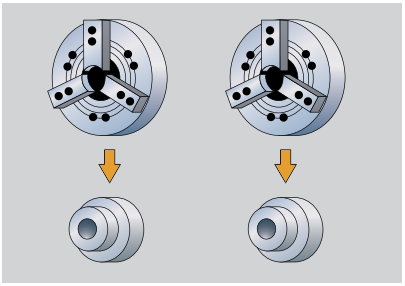
C-axis braking torque

141 N·m (104.1 ft·lb) (H250TM / QL200HM)
319 N·m (235.4 ft·lb) (H310TM / QL300HM)

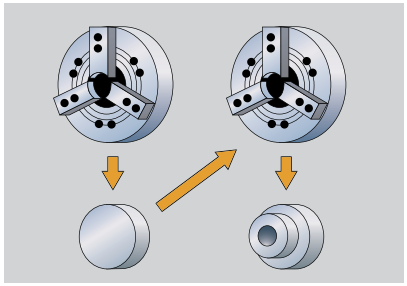
C-axis contouring torque

76.3 N·m (56.3 ft·lb) (H250TM / QL200HM)
189 N·m (146.1 ft·lb) (H310TM / QL300HM)

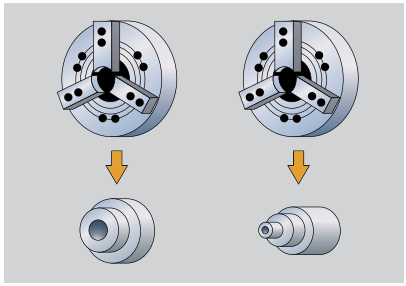
Machining Application



Turning Identifical Parts on Both Spindles



First Step on Left Spindle &Second Step on Right Spindle

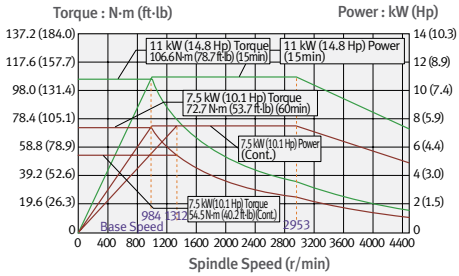


Turning Different Parts on Spindle

Main Spindle Power-torque Diagram

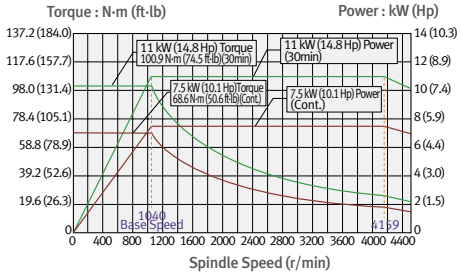
PUMA HT230T std.

- Max. spindle speed : 4500 r/min
- Motor power : 11 kW (14.8 Hp)



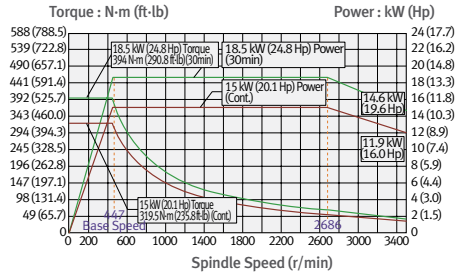
PUMA H250T / QL200H std.

- Max. spindle speed : 4500 r/min
- Motor power : 11 kW (14.8 Hp)



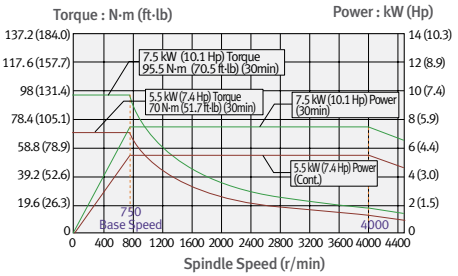
PUMA H310T / QL300H std.

- Max. spindle speed : 3500 r/min
- Motor power : 18.5 kW (24.8 Hp)



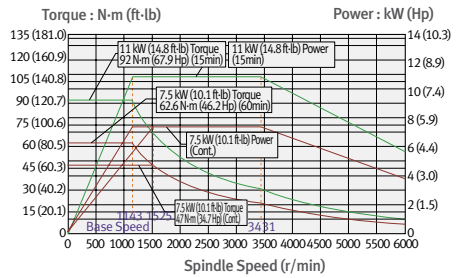
PUMA HT230TG std.

- Max. spindle speed : 4500 r/min
- Motor power : 7.5 kW (10.1 Hp)



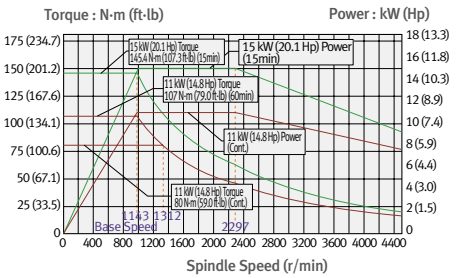
PUMA HT230T opt.

- Max. spindle speed : 6000 r/min
- Motor power : 11 kW (14.8 Hp)



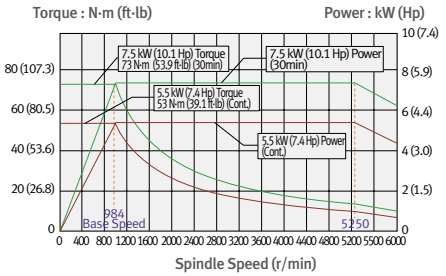
PUMA HT230T opt.

- Max. spindle speed : 4500 r/min
- Motor power : 15 kW (20.1 Hp)



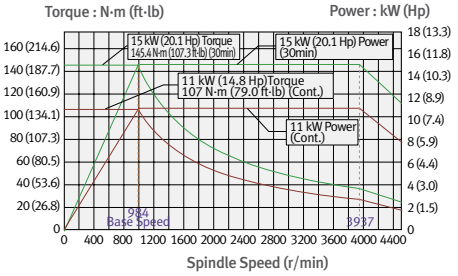
PUMA HT230TG opt.

- Max. spindle speed : 6000 r/min
- Motor power : 7.5 kW (10.1 Hp)



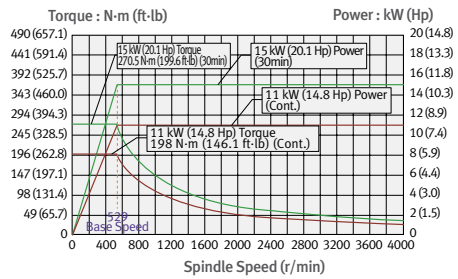
PUMA HT230TG opt.

- Max. spindle speed : 4500 r/min
- Motor power : 15 kW (20.1 Hp)



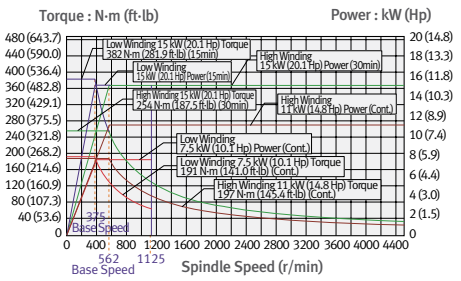
PUMA H250T / QL200H opt.

- Max. spindle speed : 4000 r/min
- Motor power : 15 kW (20.1 Hp)



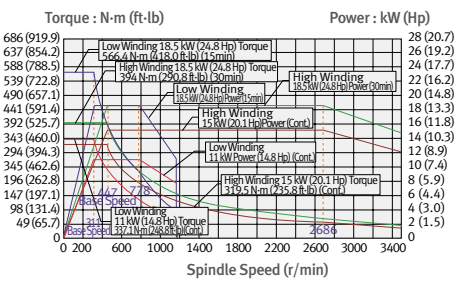
PUMA H250T / QL200H opt.

- Max. spindle speed : 4500 r/min
- Motor power : 15 kW (20.1 Hp) (High / Low winding)

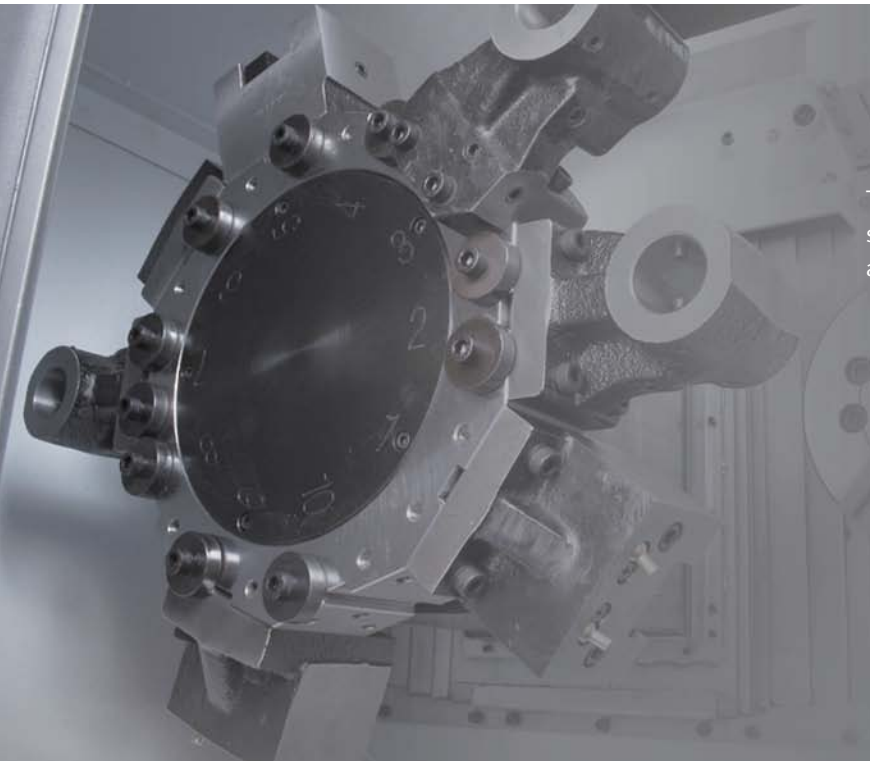


PUMA H310T / QL300H opt.

- Max. spindle speed : 3500 r/min
- Motor power : 18.5 kW (24.8 Hp) (High / Low winding)



Turret



The heavy duty design provides unsurpassed rigidity for heavy stock removal, fine surface finishes, Turning tools are securely attached to the turret by wedge clamps.

Index time (1-station swivel)

0.25/0.3/0.35 s

(HT230T/H250T/H310T)
(HT230TG/QL200H/QL300H)

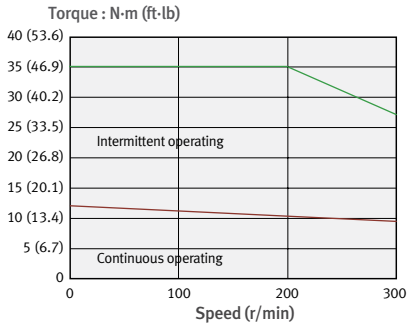
No.of tool station

Left 10 + Right 10

Rotary tool spindle power-torque diagram

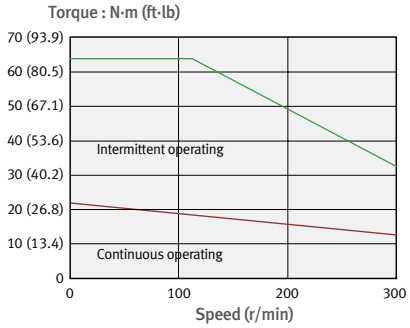
PUMA H250TM / QL200HM

- Max. tool spindle speed : 3000 r/min
- Motor power : 3 kW (4.0 Hp)

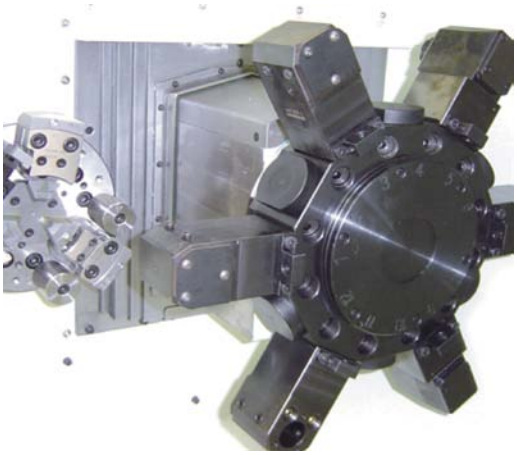


PUMA H310TM / QL300HM

- Max. tool spindle speed : 3000 r/min
- Motor power : 4 kW (5.4 Hp)



VDI Turret *



Total 24 tool stations turret (VDI) make it possible to complete complicated parts requiring many tools in just one set-up.

No.of tool station

Left 10 + Right 10

H250TM / QL200HM **VDI 30**

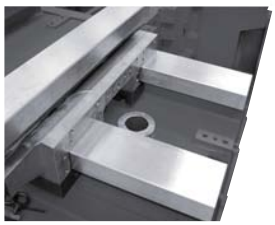
H310TM / QL300HM **VDI 40**

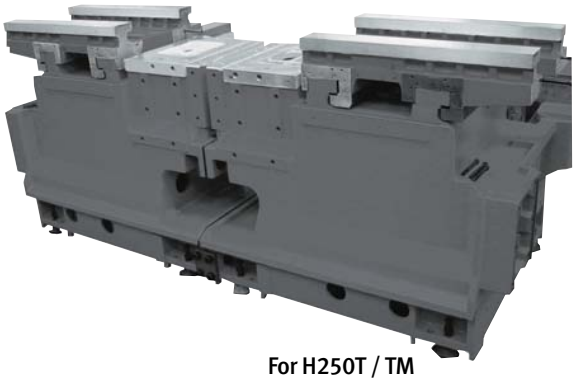
Machine Construction

All guide ways are wide wrap-around rectangular type for unsurpassed longterm rigidity and accuracy

Exclusive bed design provides exceptional accessibility to the chuck for convenient loading / unloading of parts. Separated left and right bed minimizes the effect of vibration in various cutting conditions and realize the high reliability.

For H250T / TM





For H250T / TM

Working Range

A : Max.turning dia.

230 mm (9.1 inch) (HT230T)

250/340 mm (9.8/13.4 inch) (HT250T/TM)

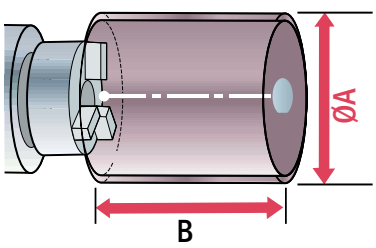
400 mm (15.7 inch) (HT310T/TM)

B : Max.turning Length

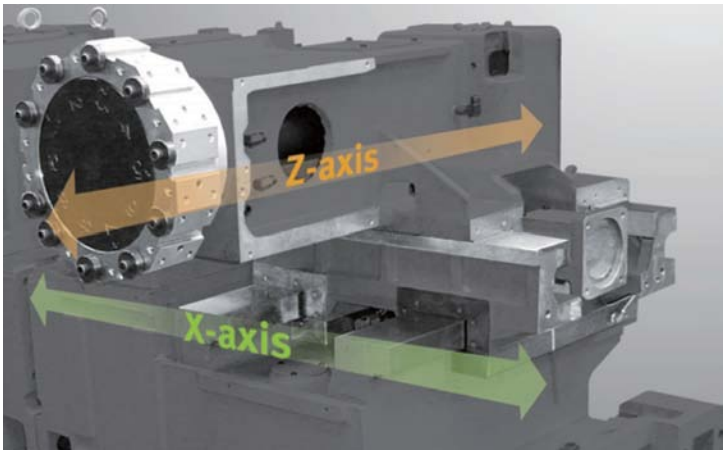
165 mm (6.5 inch) (HT230T)

200 mm (7.9 inch) (HT250T/TM)

230 mm (9.1 inch) (HT310T/TM)



Left and Right side have the same working capacity.



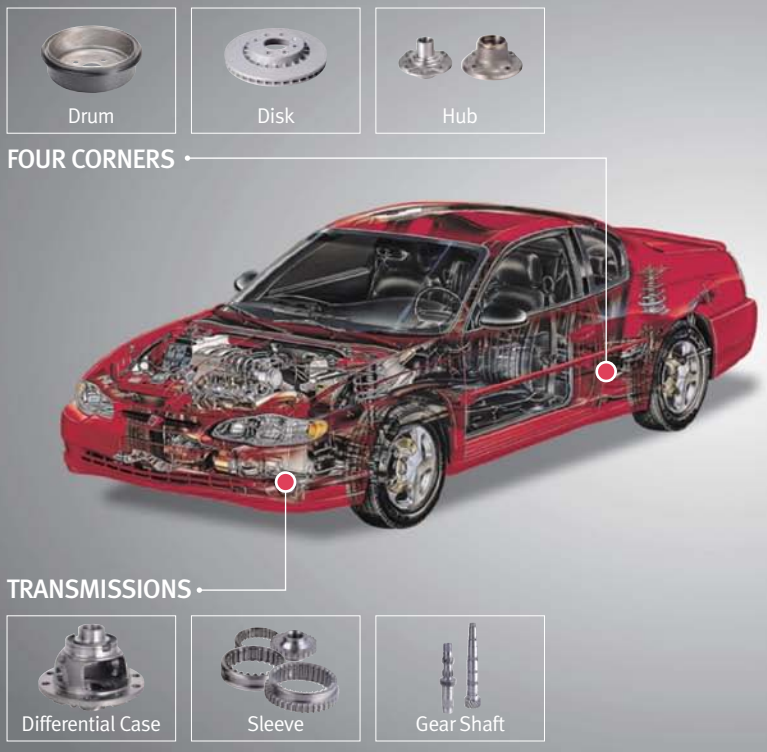
	Axis travel (HT230T / H250T / H310T)	Rapid travel (HT230T / H250T / H310T)
X-axis	**140/180/210** mm (5.5/7.1/8.3 inch)	**24** m/min (0.9 ipm)
Z-axis	**165/200/230** mm (6.5/7.9/9.1 inch)	**24** m/min (0.9 ipm)

Gantry Loader Application

PUMA HT230TG / QL200H [HM] / QL300H [HM]

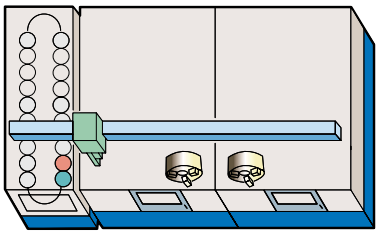
Twin spindles and Twin turrets
The machine realizes high productivity

From transmissions to four corner components which have any different shape, size and capacity are capable to be manufactured by Gantry Loader System.

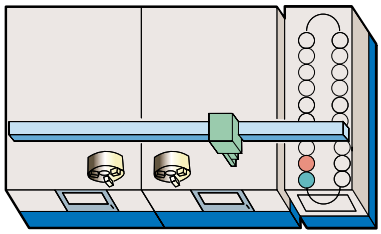


Variation of Gantry Loader Application (PUMA HT230TG /QL200H /QL300H)

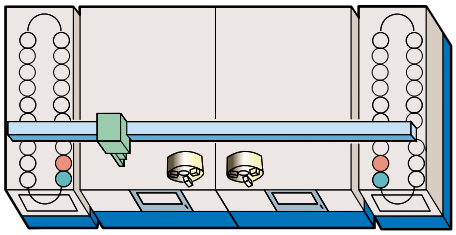
A1-type std.



A2-type opt.



A3-type opt.



(● Loading position, ● Unloading postion)

Gantry Loader

Axis travel of Gantry loader*

PUMA HT230TG / QL200H [HM] / QL300H [HM]

X-axis **1850/2010/4200** mm
(72.8/79.1/165.4 inch)

Y-axis **545/700/780** mm
(21.5/27.6/30.7 inch)

Z-axis **180/200/80** mm
(7.1/7.9/3.1 inch)

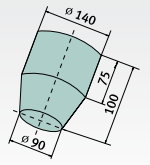
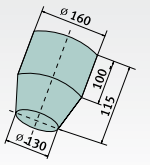
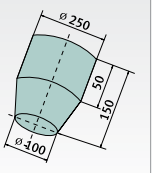
* : Axis travel of gantry loader is
for A1-type gantry loader application

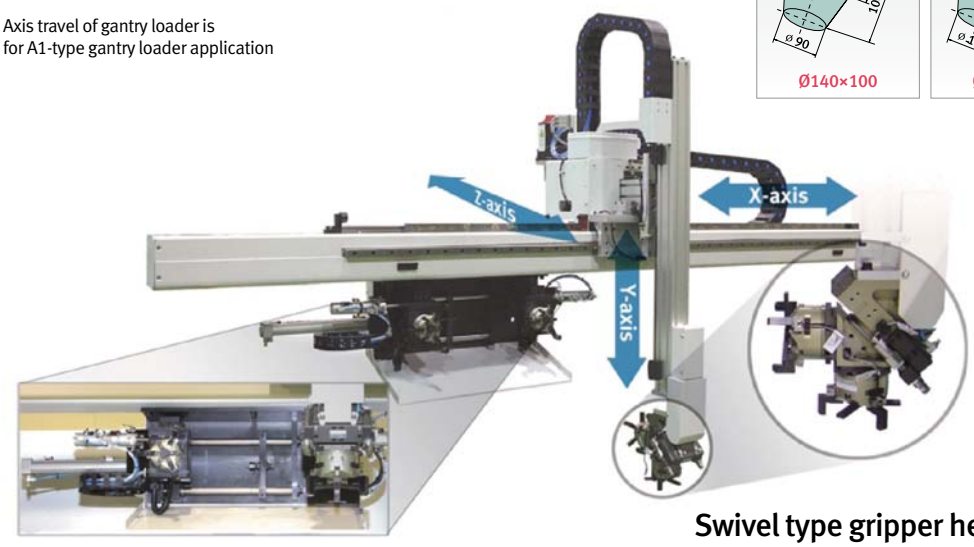
Servo driven CNC gantry loader

PUMA HT230TG / QL200H [HM] : 3-axis servo driven (on X, Y, Z-axis)

PUMA QL300H [HM] : 2-axis servo driven (on X, Y-axis)

Max. G-Loader Handling Size
(Max. turning dia.×Max. turning length)

PUMA HT230TG	PUMA QL200H/HM	PUMA QL300H/HM
		
Ø140×100	Ø160×115	Ø250×150

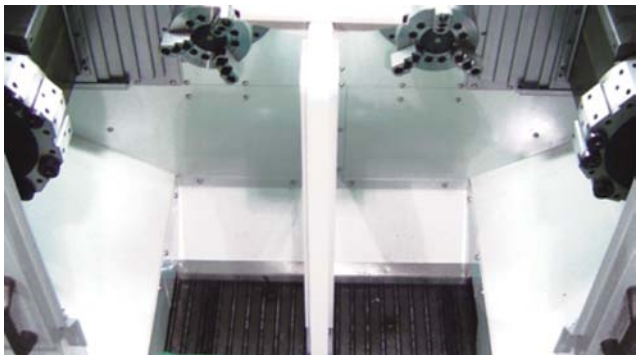


Swivel type gripper head

Wrist swivel angle : **180°**

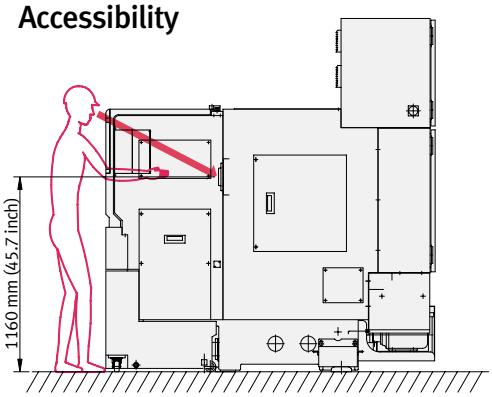
Ergonomic Design

Easy chip disposal



A large capacity chip pan is installed separately from the machine bed so that heat generated by cut chips will not distort the bed. The large coolant capacity allows a constant coolant temperature to be maintained for precision machining.

Accessibility

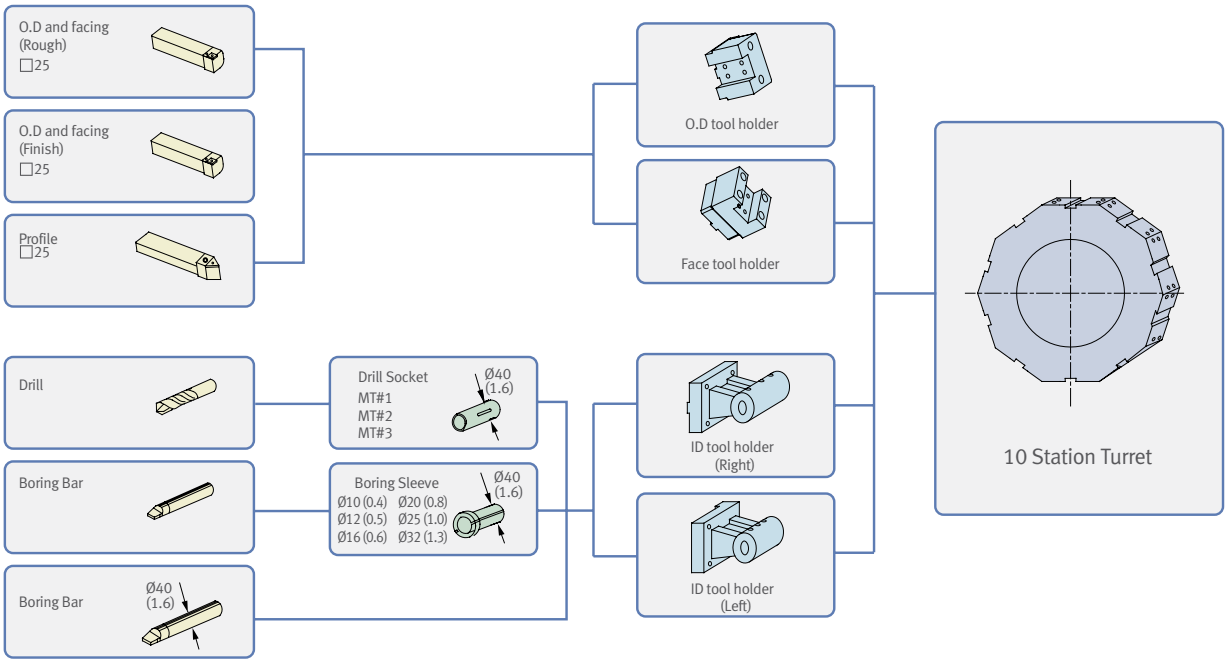


Easy accessibility to setup work pieces and tools which ensures operation efficiency.

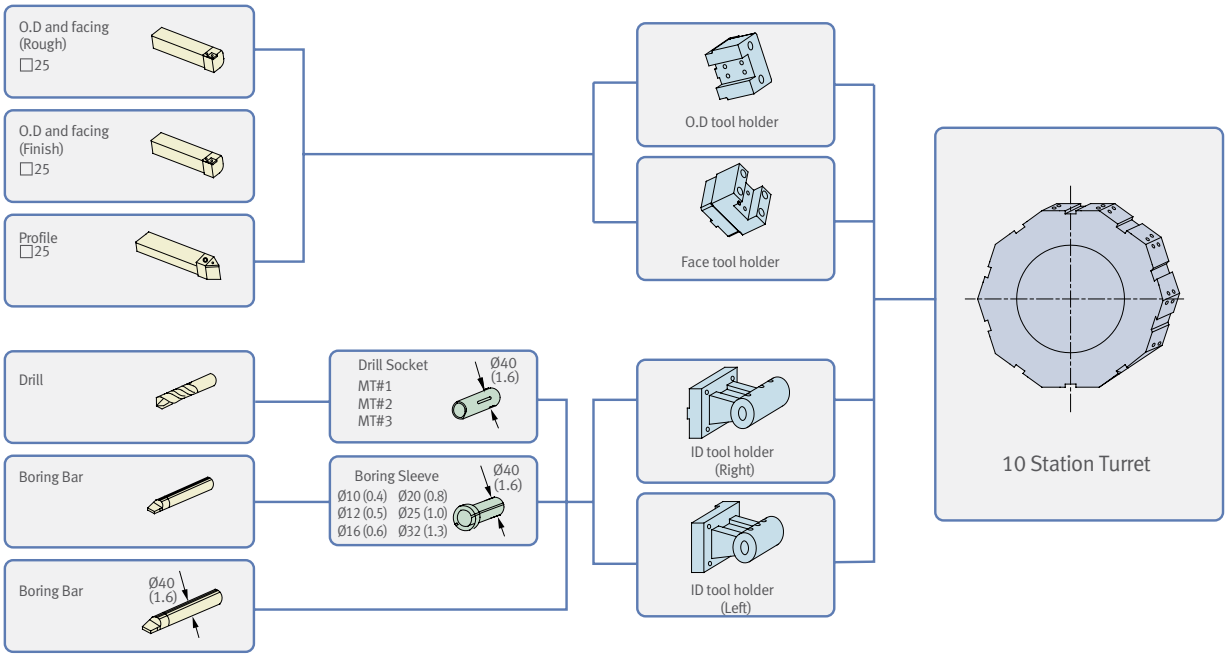
Tooling System

unit : mm (inch)

PUMA HT230T / HT230TG



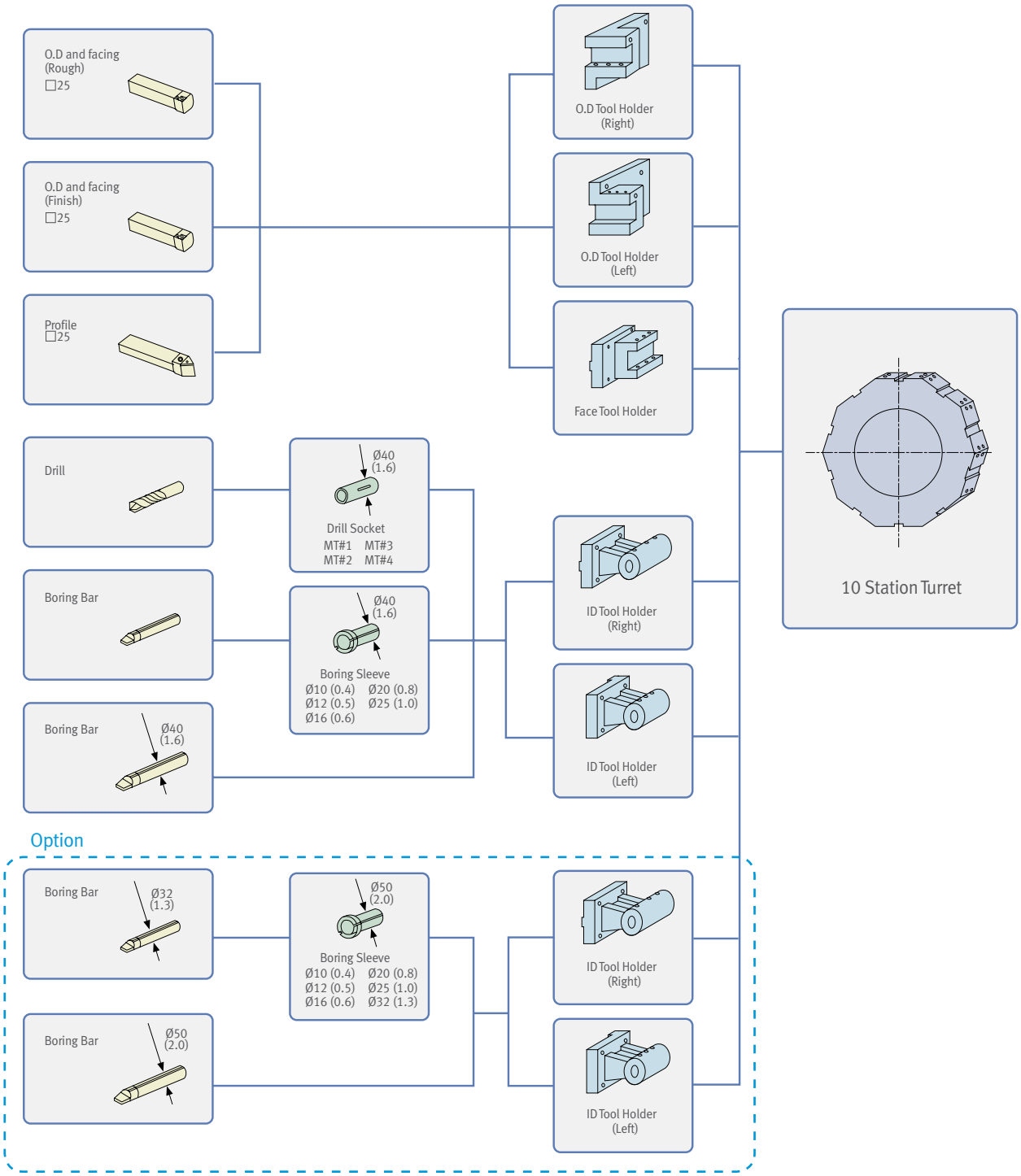
PUMA H250T / QL200H



Note) Above tooling system is our recommendation. Depending on export condition, the standard tooling packed with the machine can be different.

unit : mm (inch)

PUMA H310T / QL300H

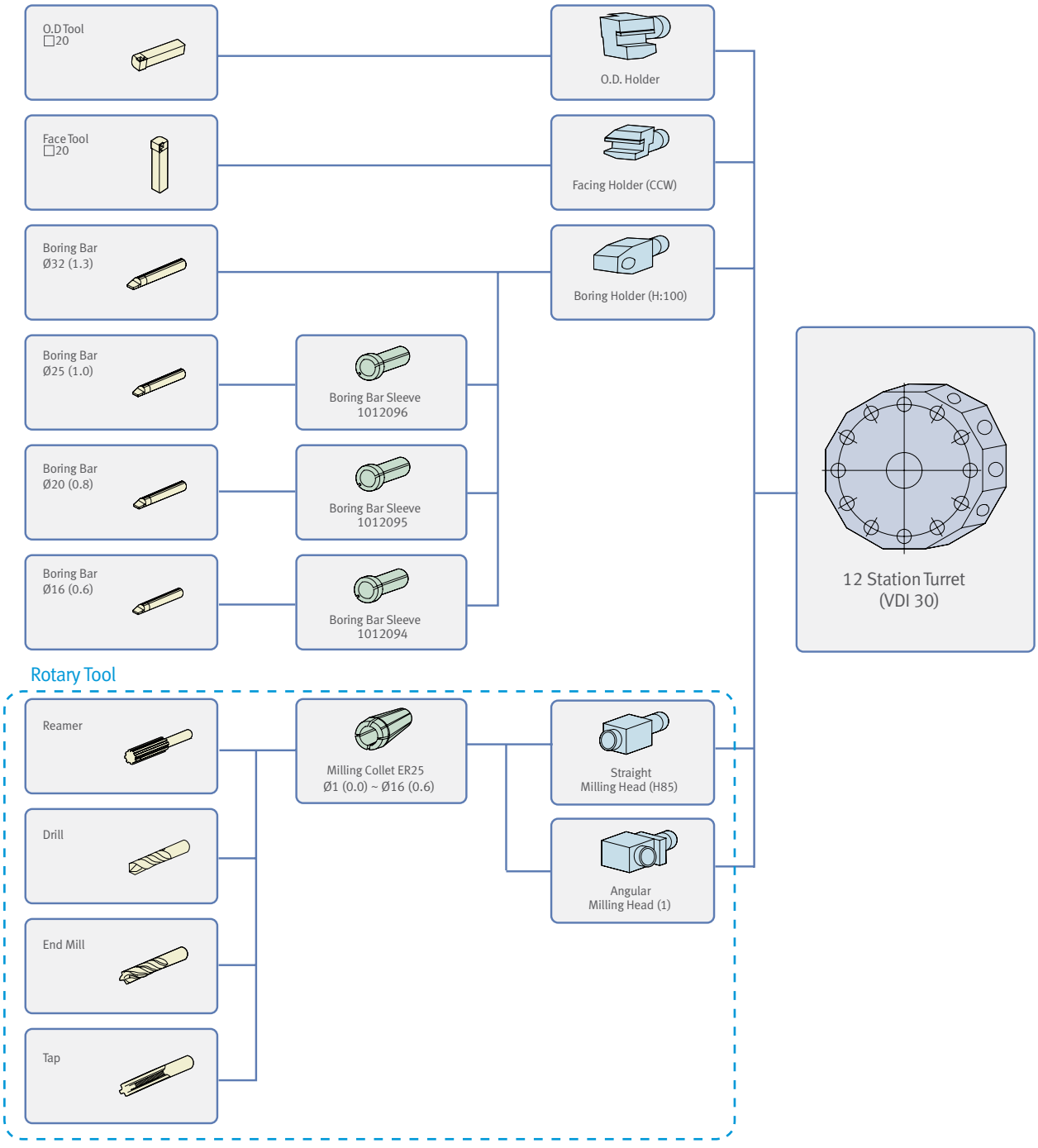


Note) Above tooling system is our recommendation. Depending on export condition, the standard tooling packed with the machine can be different.

Tooling System

unit : mm (inch)

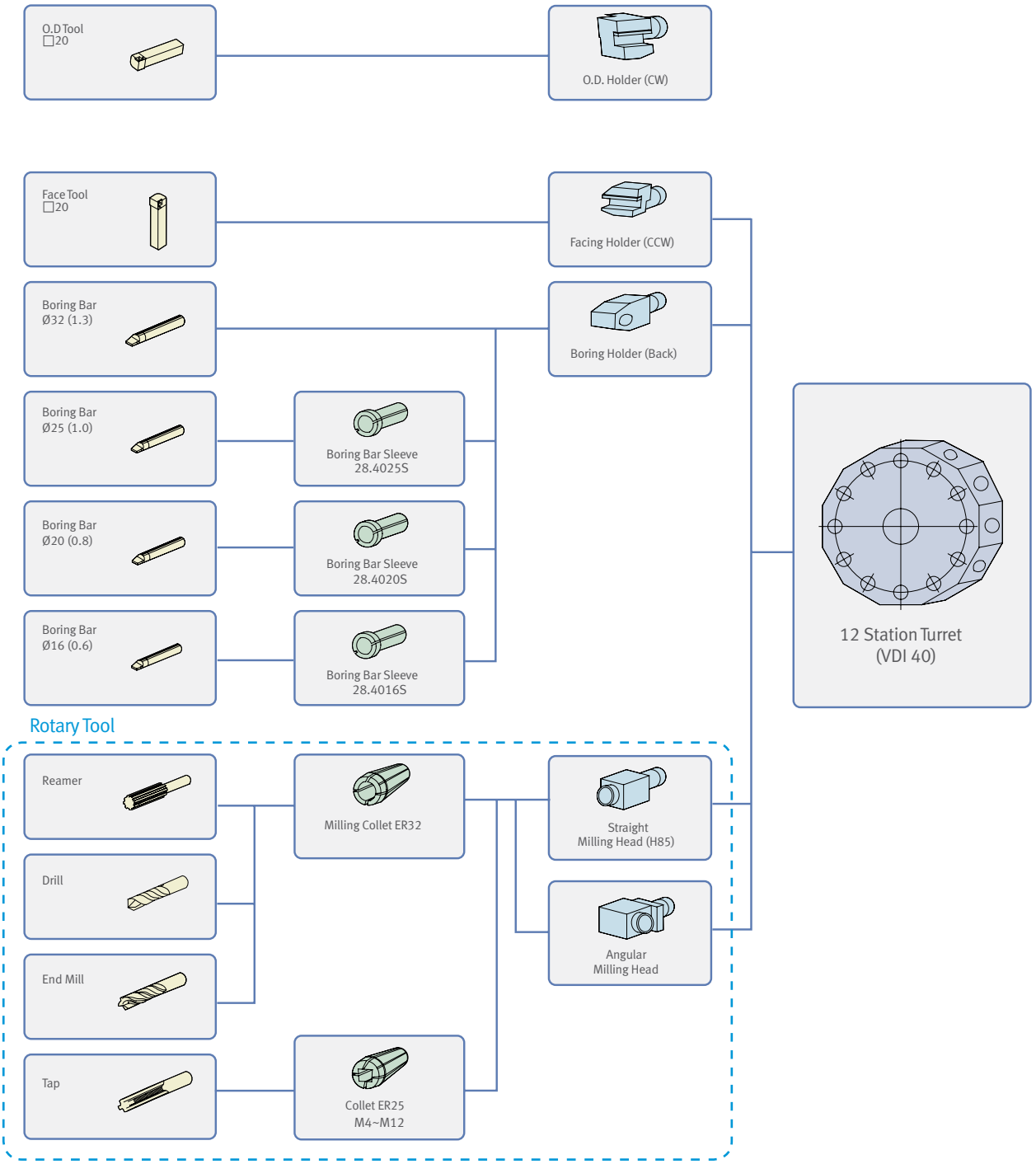
PUMA HT250TM / QL200HM



Note) Above tooling system is our recommendation. Depending on export condition, the standard tooling packed with the machine can be different.

unit : mm (inch)

PUMA HT310TM / QL300HM

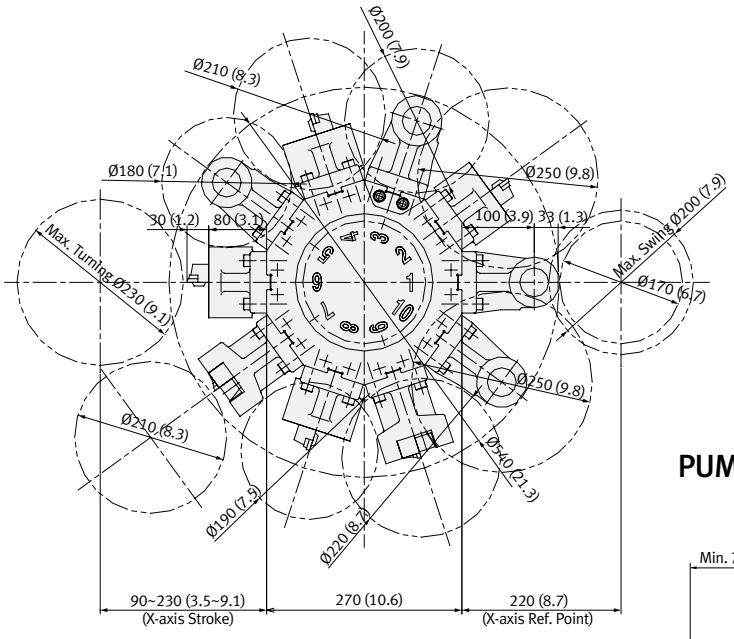


Note) Above tooling system is our recommendation. Depending on export condition,
the standard tooling packed with the machine can be different.

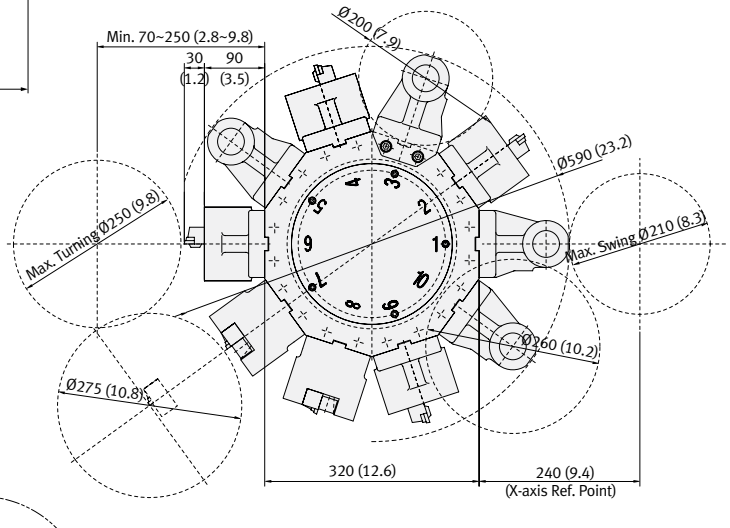
Tool Interference Diagram

unit : mm (inch)

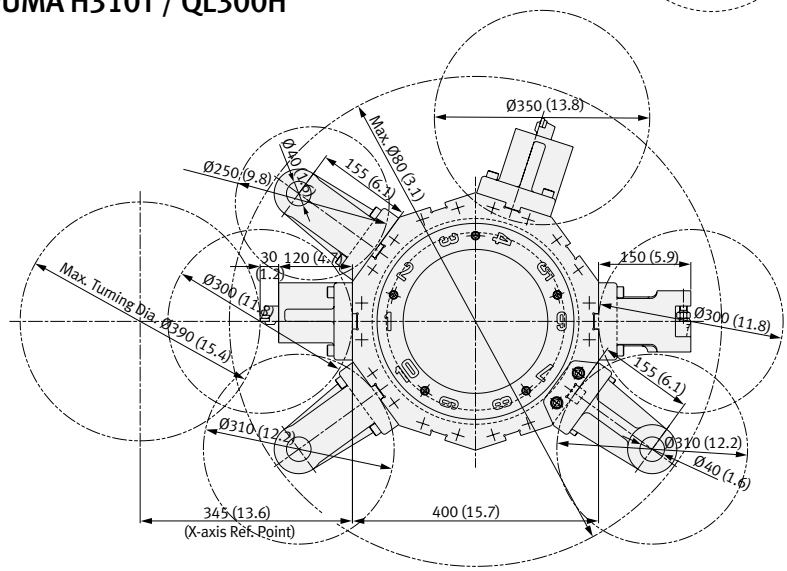
PUMA HT230T / HT230TG



PUMA H250T / QL200H

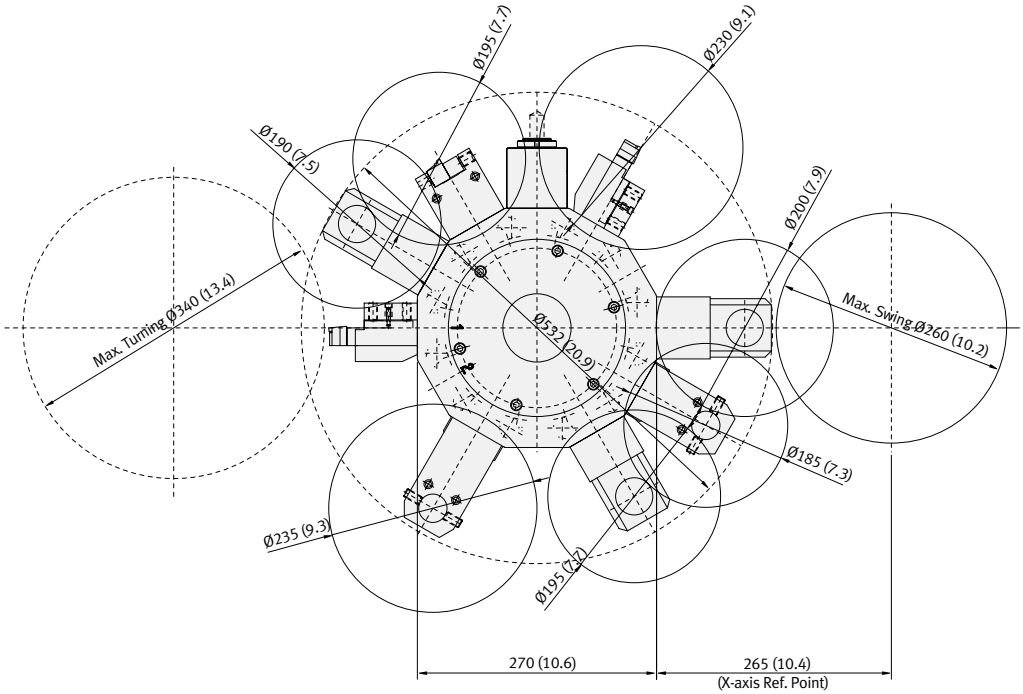


PUMA H310T / QL300H

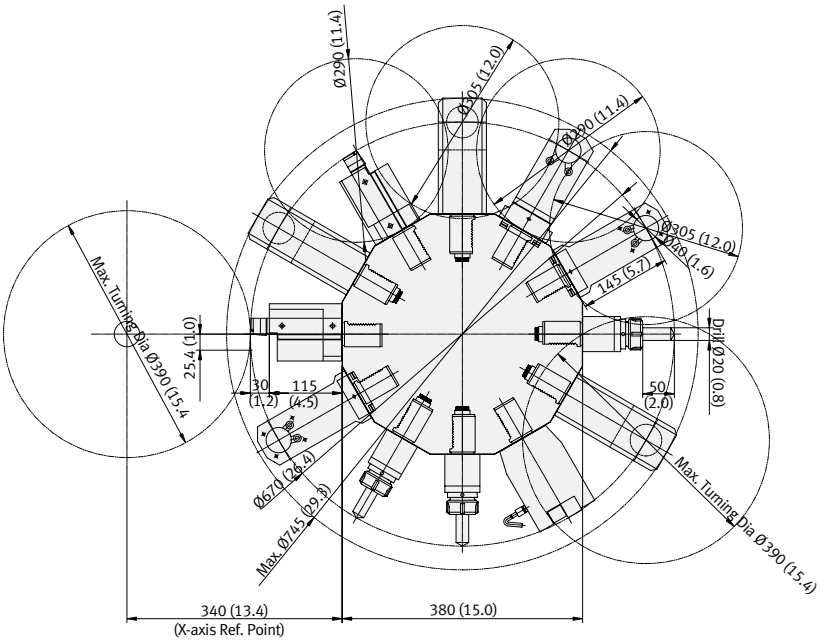


unit : mm (inch)

PUMA H250TM / QL200HM



PUMA H310TM / QL300HM

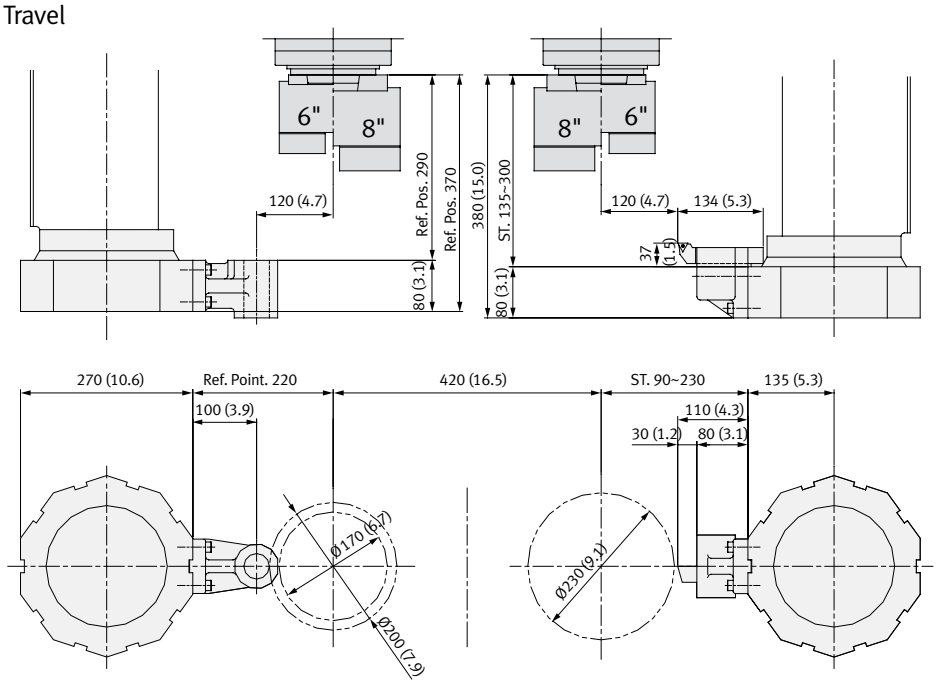


Working Range

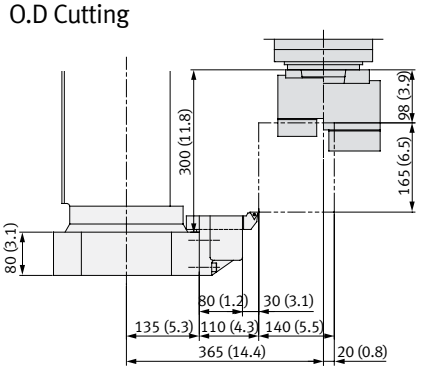
unit : mm (inch)

PUMA HT230T / HT230TG

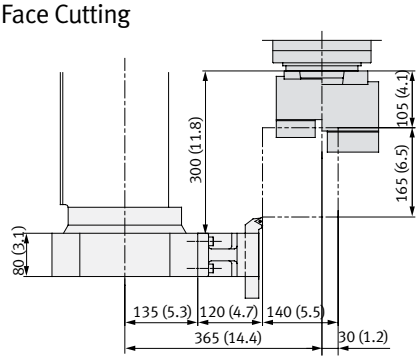
Axis Travel



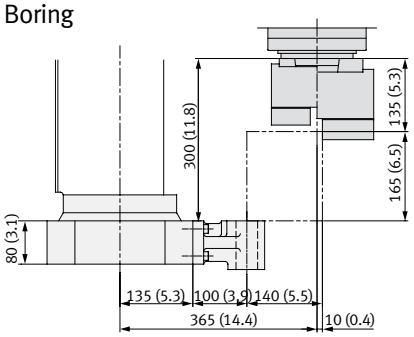
O.D Cutting



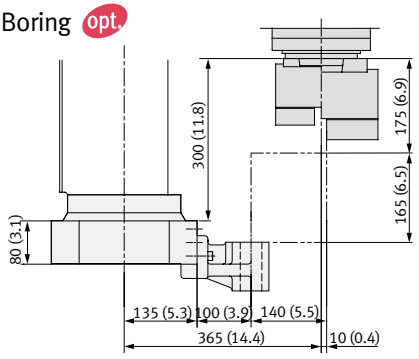
Face Cutting



Boring



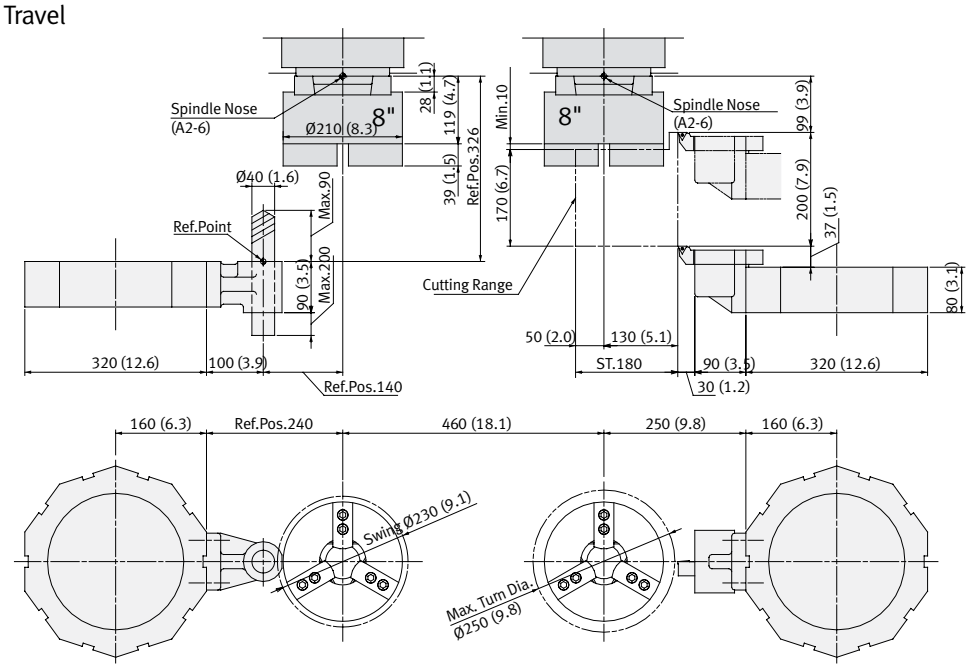
Boring opt.



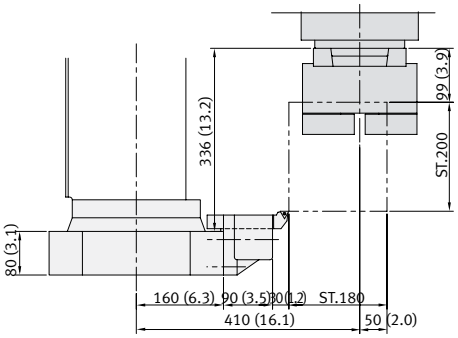
unit : mm (inch)

PUMA H250T / QL200H

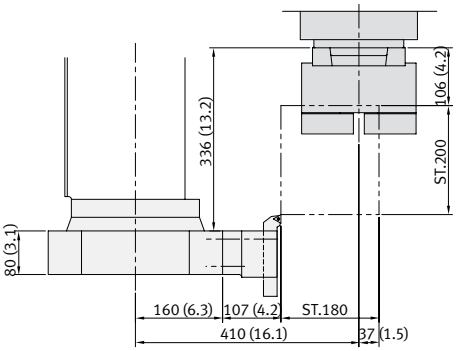
Axis Travel



O.D Cutting



Face Cutting



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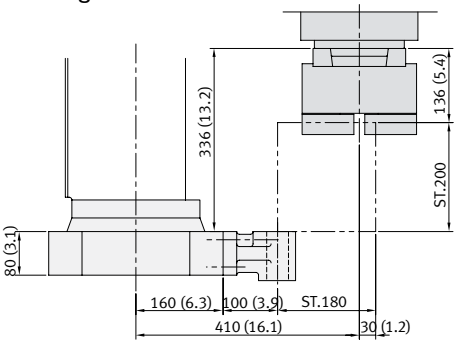
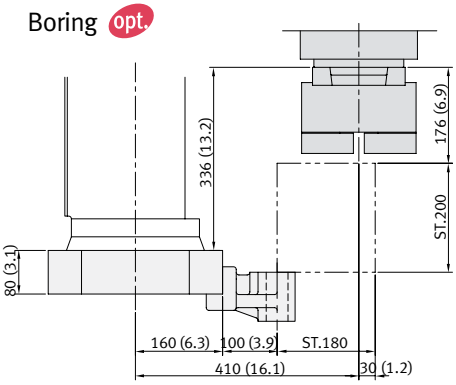


Boring opt.

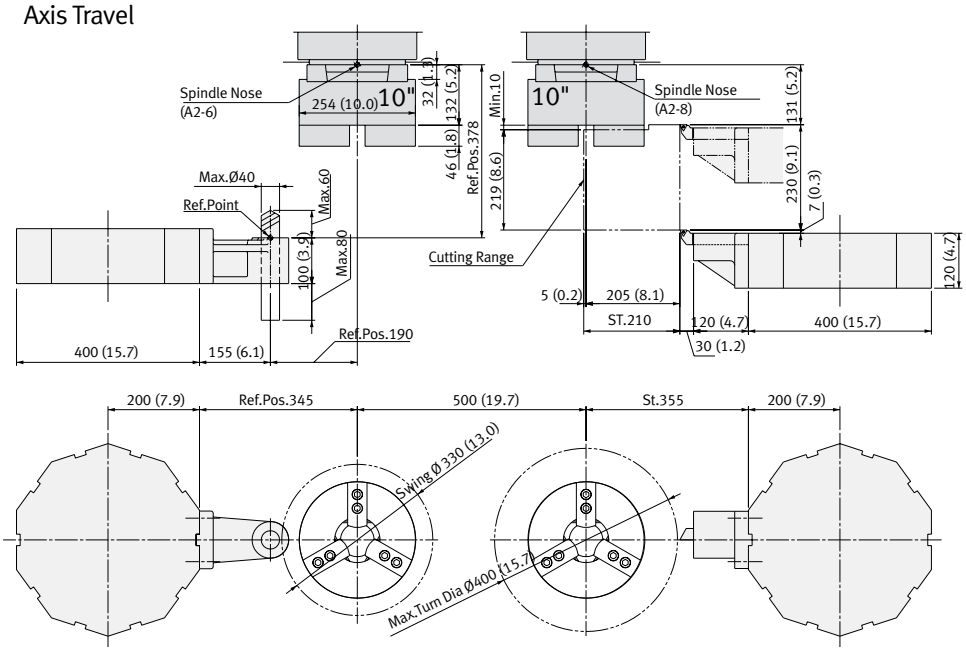


Working Range

unit : mm (inch)

PUMA H310T / QL300H

Axis Travel



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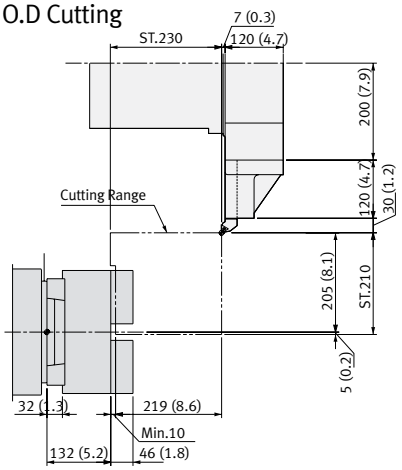
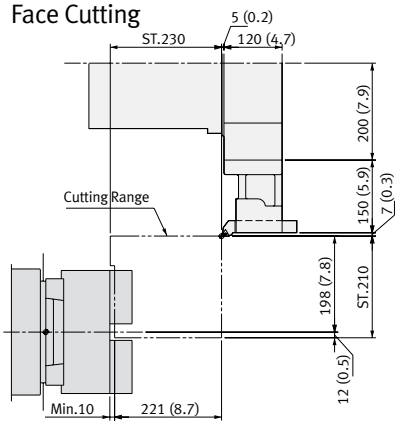


Face Cutting



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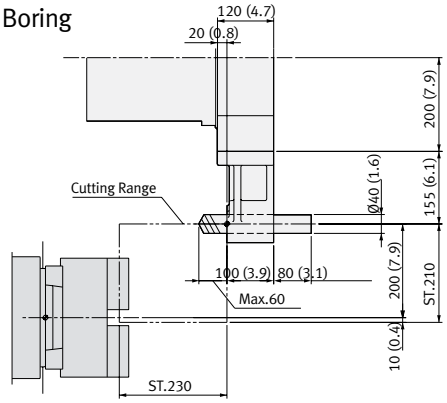
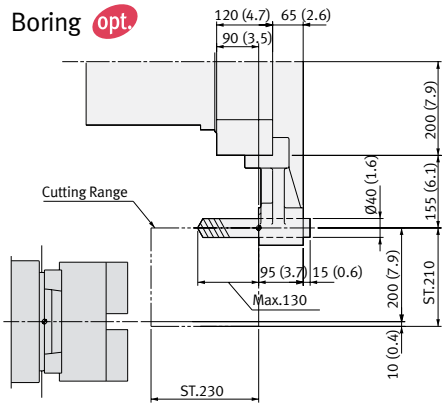


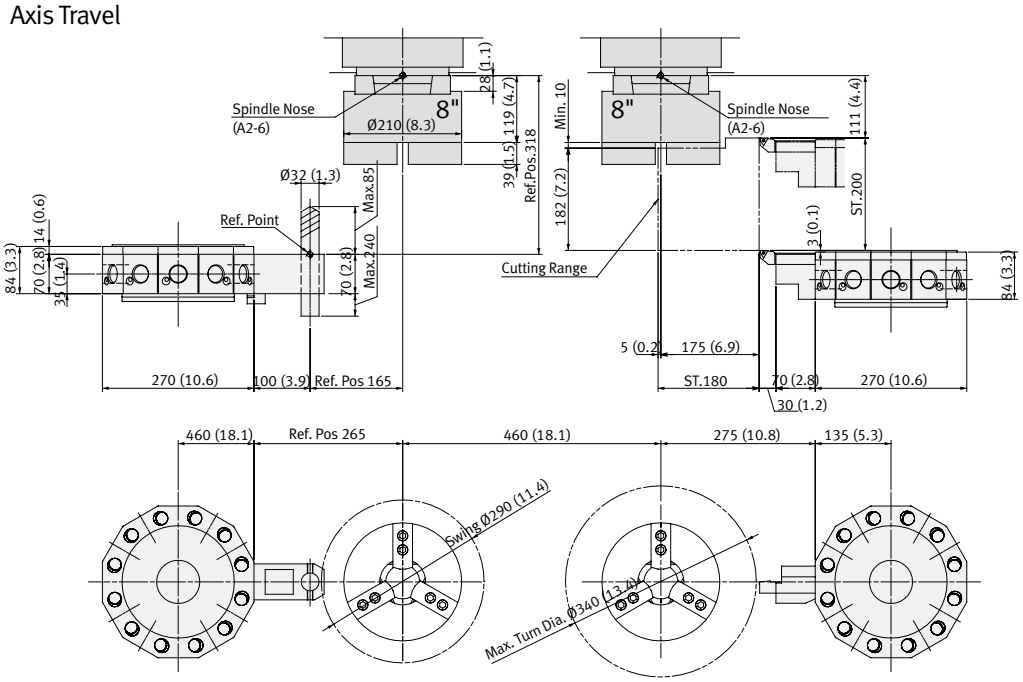
Boring opt.



unit : mm (inch)

PUMA H250TM / QL200HM

Axis Travel



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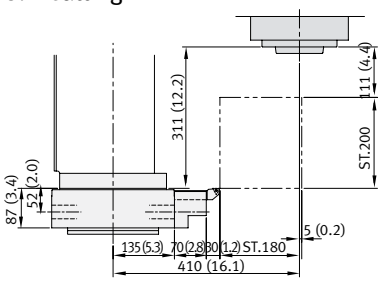
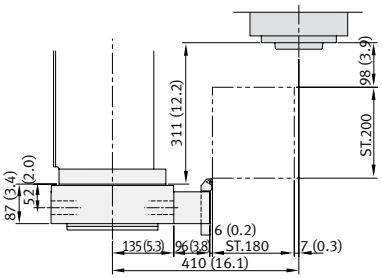
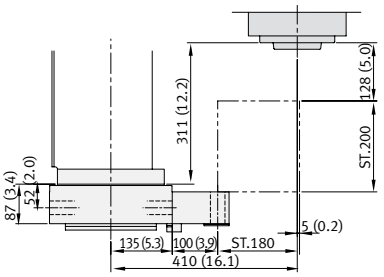


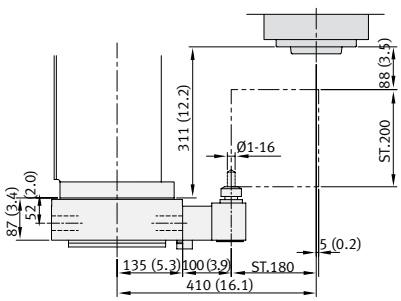
Face Cutting



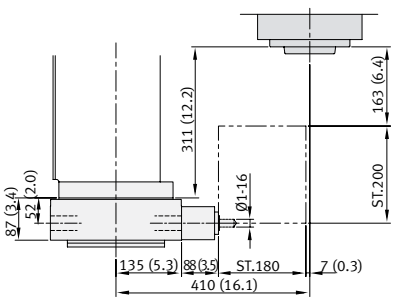
Boring



Angular milling head



Straight milling head

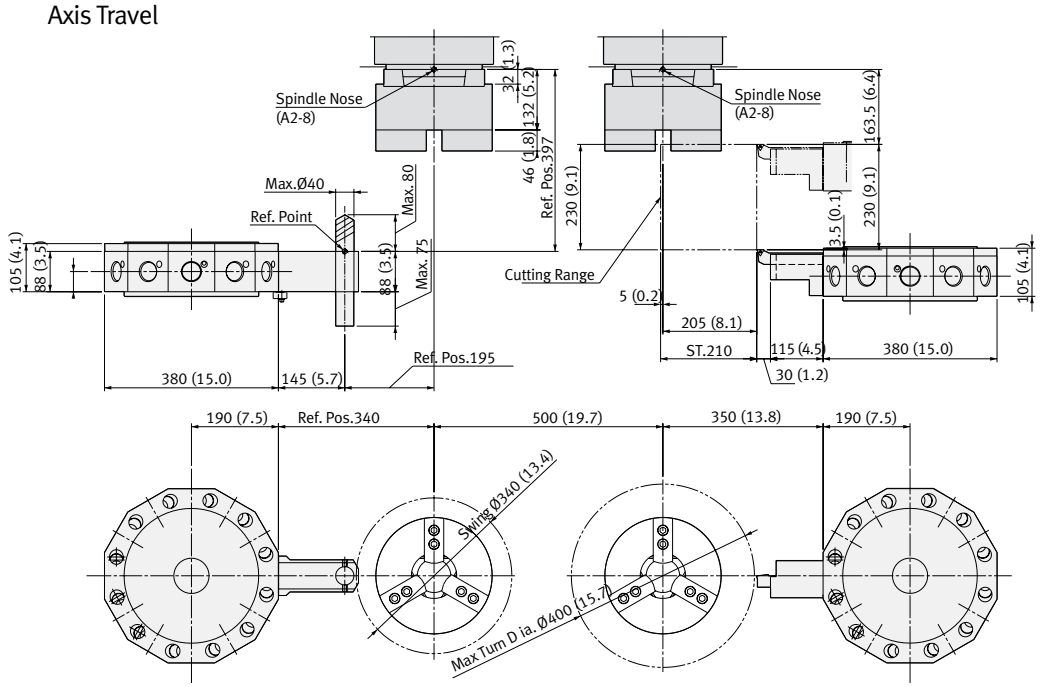


Working Range

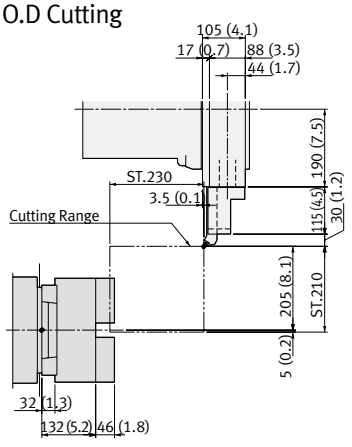
unit : mm (inch)

PUMA H310TM / QL300HM

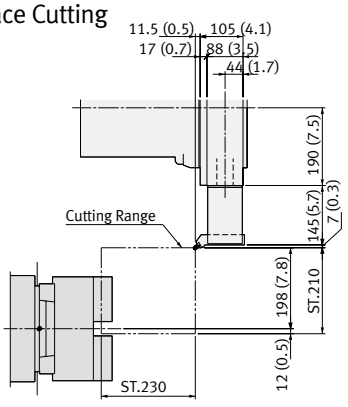
Axis Travel



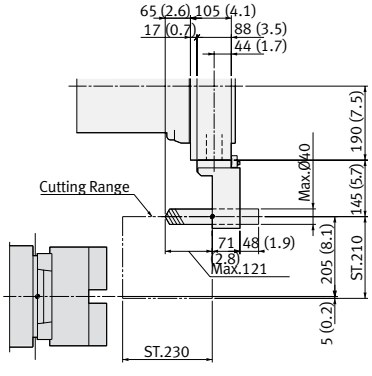
O.D Cutting



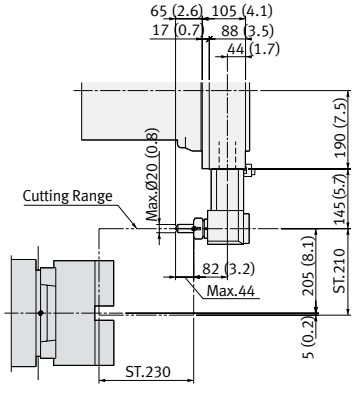
Face Cutting



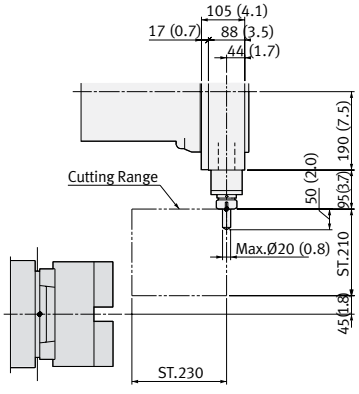
Boring opt.



Angular milling head



Straight milling head

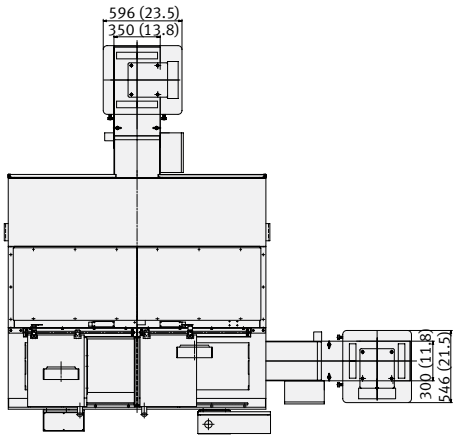


External Dimension

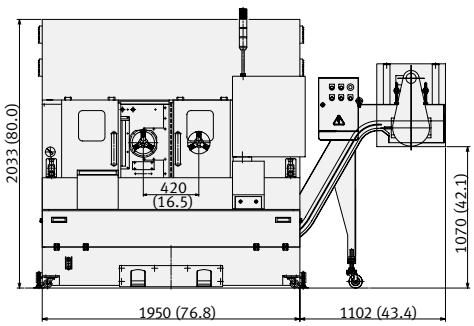
unit : mm (inch)

PUMA HT230T

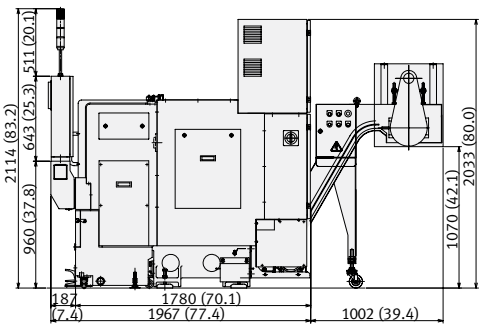
Top View



Front View

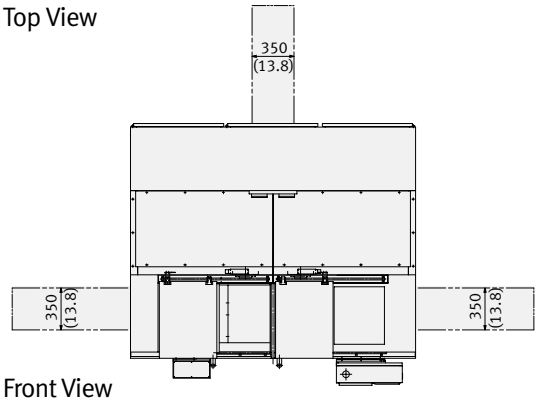


Side View

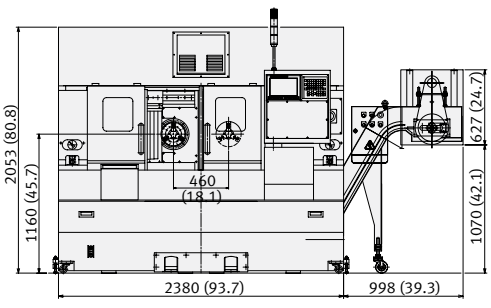


PUMA H250T / H250TM

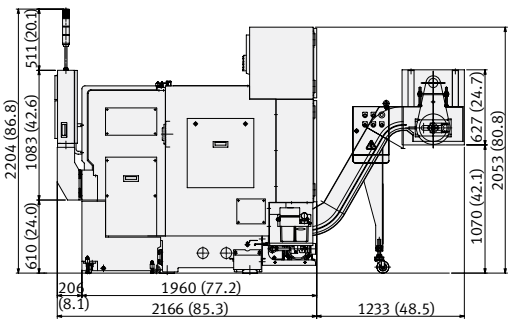
Top View



Front View



Side View

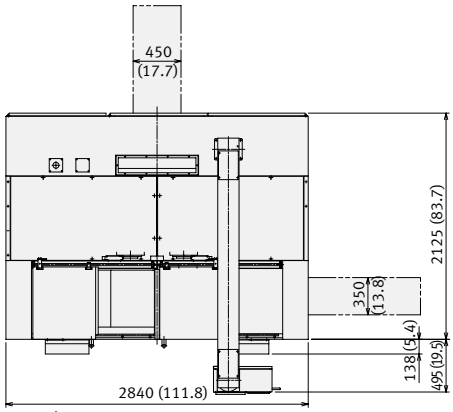


External Dimension

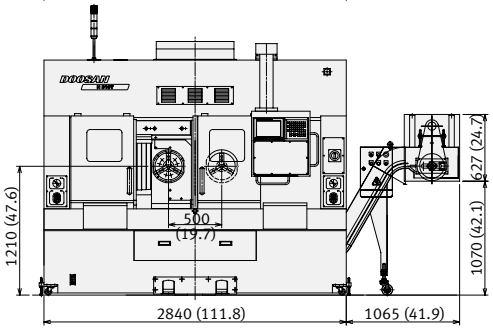
unit : mm (inch)

PUMA H310T / 310TM

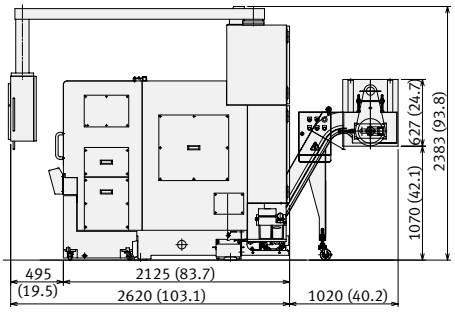
Top View



Front View

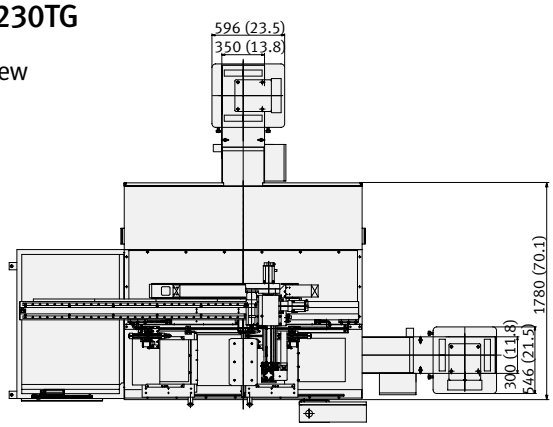


Side View



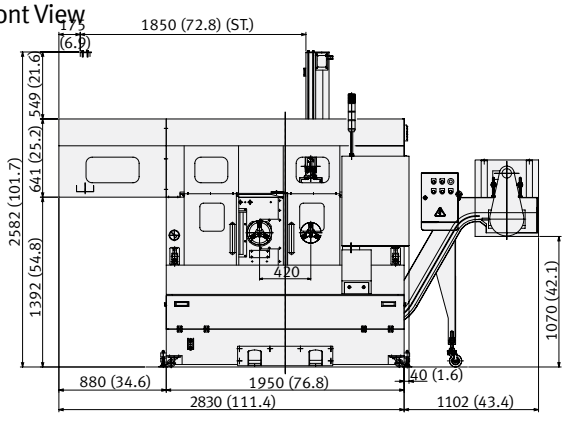
PUMA H230TG

Top View

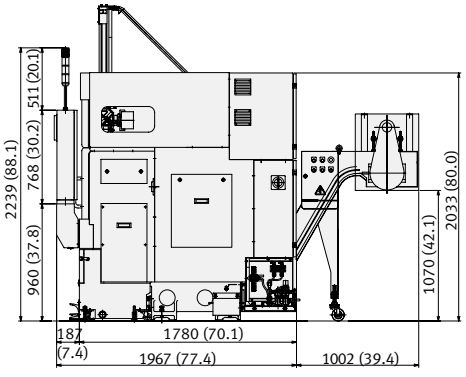


This picture is for A1-type gantry loader application

Front View



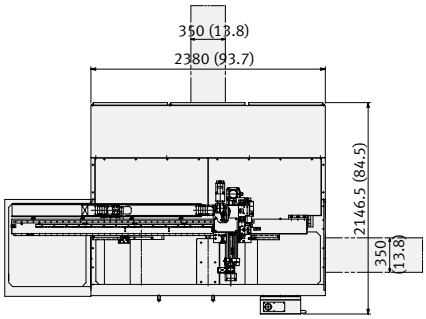
Side View



unit : mm (inch)

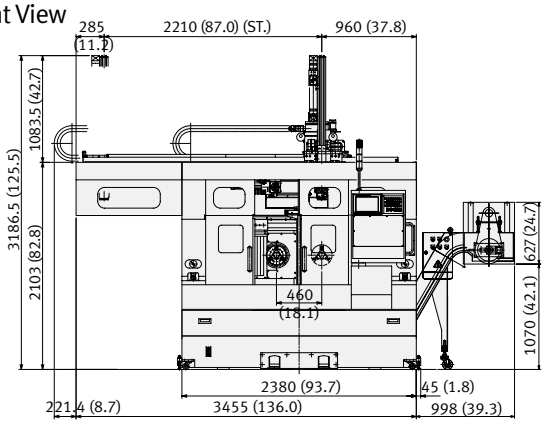
PUMA QL200H /QL200HM

Top View

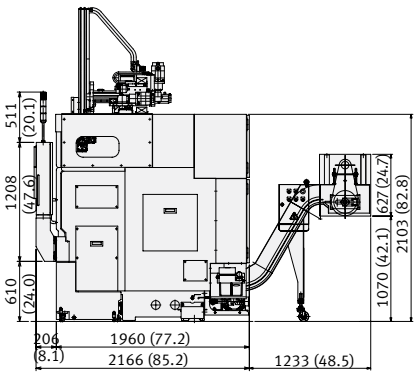


This picture is for A1-type gantry loader application

Front View

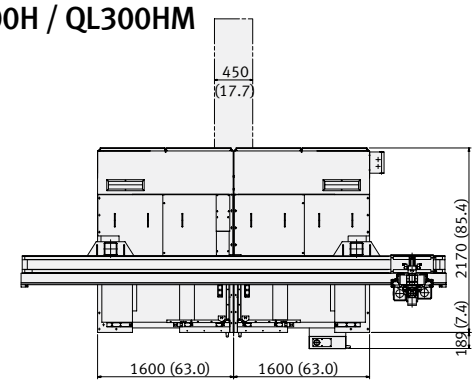


Side View



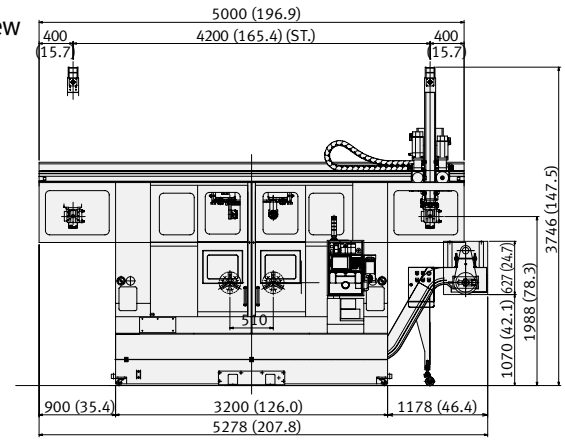
PUMA QL300H / QL300HM

Top View

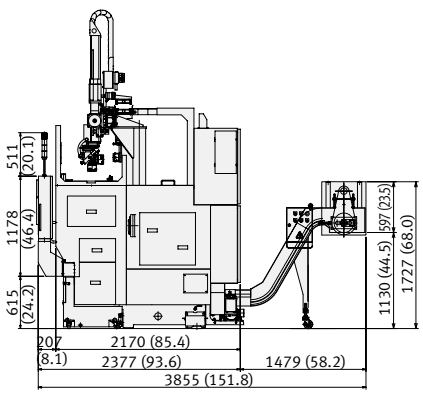


This picture is for A3-type gantry loader application

Front View



Side View



Machine Specifications

Description		Unit	PUMA HT230T [HT230TG]	PUMA H250T [QL200H]	PUMA H310T [QL300H]	PUMA H250TM [QL200HM]	PUMA H310TM [QL300HM]
Capacity	Distance of spindle centers	mm (inch)	420 (16.5)	460 (18.1)	500 (19.7)	460 (18.1)	500 (19.7)
	Recommendable turning dia.	mm (inch)	Ø160 (6.3)	Ø210 (8.3)	Ø310 (12.2)	Ø210 (8.3)	Ø310 (12.2)
	Max. turning dia.	mm (inch)	Ø230 (9.1)	Ø250 (9.8)	Ø400 (15.7)	Ø340 (13.4)	Ø400 (15.7)
	Max. turning length	mm (inch)	Ø165 (6.5)	200 (7.9)	230 (9.1)	200 (7.9)	230 (9.1)
Travels	X/Z-axis travel	mm (inch)	140/165 (5.5/6.5)	180/200 (7.1/7.9)	210/230 (8.3/9.1)	180/200 (7.1/7.9)	210/230 (8.3/9.1)
	X/Z-axis rapid traverse	m/min (ipm)	24/24 (944.9/944.9)				
Spindle (Left / Right)	Max. spindle speed	r/min	4500		3500	4500	3500
	Spindle nose	ASA	A2-5	A2-6	A2-8	A2-6	A2-8
	Spindle bearing dia. (front)	mm (inch)	Ø90 (3.5)	Ø100 (3.9)	Ø120 (4.7)	Ø100 (3.9)	Ø120 (4.7)
	Spindle bore dia.	mm (inch)	Ø55 (2.2)	Ø62 (2.4)	Ø77 (3.0)	Ø62 (2.4)	Ø77 (3.0)
	C-axis indexing	deg	-			360˚ (in 0.001˚ increment)	
Turret	Turret type		V10			VDI 130	VDI 140
	No. of tool station	st	10+10			12+12	
	OD tool size (Max.)	mm (inch)	25 (1.0)			25 (1.0)	
	Boring bar dia. (Max.)	mm (inch)	Ø40			Ø32	Ø40
	Indexing time (1-station swivel)	s	0.25	0.3	0.35	0.3	0.35
	Rotary tool spindle speed (Max.)	r/min	-			3000	
Motors	Main spindle motor	kW (Hp)	11 [7.5] (14.8 [10.1])	11 (14.8)	18.5 (24.8)	11 (14.8)	18.5 (24.8)
	Rotary tool spindle motor (15min.)	kW (Hp)	-			3.0 (4.0)	4.0 (5.4)
	Servo motor (X/Z-axis)	kW (Hp)	1.2/1.2 [1.0/1.2] (1.6/1.6 [1.3/1.6])	1.2/1.6 (1.6/2.1)	3.0/3.0 (4.0/4.0)	1.2/1.6 (1.6/2.1)	3.0/3.0 (4.0/4.0)
	Coolant pump	kW (Hp)	0.4				
Power source	Electric power supply (Rated capa.)	kVA	25	35	60 [70]	40	70 [80]
Machine Dimensions	height	mm (inch)	2033 (80.0)	2053 (80.8)	2383 (93.8)	2053 (80.8)	2383 (93.8)
	Length	mm (inch)	1950 (76.8)	2380 (93.7)	2840 (111.8)	2380 (93.7)	2840 (111.8)
	Width	mm (inch)	1780 (70.1)	1960 (77.2)	2125 (83.7)	1960 (77.2)	2125 (83.7)
	Weight	kg (lb)	3700 (8157.0)	5300 (11684.3)	7800 (17195.8)	5300 (11684.3)	7800 (17195.8)

[ ] : The machine with Gantry Loader

HT series

Standard Feature

- Coolant tank & pump
- Hydraulic pump
- Work light
- Level bolt & plate
- Coolant pump for main turret
- Gantry top door
- Tool post (hydraulic type)
- Air blower for chuck (air blaster)
- 3 Color signal tower

Optional Feature

- Soft jaw
- Hard jaw
- Flushing coolant
- TSC (coolant/air)
- Oil skimmer
- Coolant pressure switch
- Chuck coolant (coolant blaster)
- Coolant gun
- Air gun
- Chip conveyor
- Chip bucket
- Mist collector
- Tool setter (removable)
- Work locating confirmation (air limit sensing)
- Automatic front door
- Additional MPG
- Auto power off
- Chuck clamp detection
- TSC for main/left spindle
- Signal tower
- U drill holder
- Chuck clamp confirmation
- Electric power transformer
- Air conditioner
- Electric cabinet light
- Electric line filter
- Work & tool counter
- Extra M code
- Robot interface
- Shunt trip coil
- Doosan tool monitoring system
- High coolant interface

- The specifications and information above-mentioned may be changed without prior notice.
- For more details, please contact Doosan.

Gantry Loader Specifications

Description			Unit	PUMA HT230TG			PUMA QL200H/HM			PUMA QL300H/HM		
Gantry loader application type				A1-type	A2-type	A3-type	A1-type	A2-type	A3-type	A1-type	A2-type	A3-type
Capacity	Max. work dia.×length		mm (inch)	Ø140×100 (5.5×3.9)			Ø160×115 (6.3×4.5)			Ø250×150 (9.8×5.9)		
	Max. work weight		kg (lb)	3 (6.6)			5 (11.0)			8 (17.6)		
Standard loading time			s	7			10			13		
Slide module	X-axis stroke (left-right)		mm (inch)	1850 (72.8)		3280 (129.1)	2210 (87.0)	2010 (79.1)	3580 (140.9)	4200 (165.4)		
	Y-axis stroke (up-down)		mm (inch)	545 (21.5)			700 (27.6)			780 (30.7)		
	Z-axis stroke (front-rear)		mm (inch)	180 (7.1)			200 (7.9)			80 (3.1)		
	Loading capacity (Gripper+workpiece mass)		kg (lb)	15 (33.1)			25 (55.1)			31 (68.3)		
	Max.Speed (X/Y/Z-axis)		m/min (ipm)	150/120/50 (5905.5/4724.4/1968.5)			150/110/50 (5905.5/4330.7/1968.5)			100/80/30 (3937.0/3149.6/1181.1)		
	Servo motor power (X/Y/Z-axis)		kW	0.75/0.75/0.5			1.4/1.4/0.5			1.6/1.6/Air cylinder		
Gripper head	Gripper			2 sets of Double 3-jaw chuck type with individual spring pusher								
	Wrist swivel angle		deg	180			180			180		
	Swivel time (per every180˚)		s	0.5			0.6			1		
	Jaw stroke		mm (inch)	16 (0.6)			16 (0.6)			20 (0.8)		
	Gripping force (Max./each chuck)		N	784			980			980		
Turn around module	Gripper			2 sets of Double 3-jaw chuck type with individual spring pusher								
	Distance between center		mm (inch)	420 (16.5)			460 (18.1)			500 (19.7)		
	Shifting distance (Max.)		mm (inch)	245 (9.6)			260 (10.2)			320 (12.6)		
	Gripper rotating angle		deg	-			90			-		
Work stocker	Number of pallets		st.	16								
	Number of lifting device			Left	Right	Double	Left	Right	Double	Left	Right	Double
	Allowable work dia.×length (Min.)		mm (inch)	Ø50~Ø150×15 (Ø2.0~Ø5.9×0.6)			Ø25~Ø160×5 (Ø1.0~Ø6.3×0.2)			Ø200×15 (Ø7.9×0.6)		
	Allowable work loading (Max./pallet)		kg (lb)	40 (88.2)			40 (88.2)			90 (198.4)		
Power source	Electric power supply (Rated capa.)		kVA	30			40			70		
Machine Dimensions	Machine height (Max. / Min.)		mm (inch)	{2582/2037} (101.6/80.2)			{3187/2487} (125.5/97.9)			-		
	Machine dimensions	w/o chip conveyor	mm (inch)	2830×1967 (111.4×77.4)		3900×1967 (153.5×77.4)	3455×2166 (136.0×85.3)		4130×2166 (162.6×85.3)	5000×2377 (196.9×93.6)		5000×2377 (196.9×93.6)
		with side chip conveyor	mm (inch)	3932×1967 (154.8×77.4)		-	4453×2166 (175.3×85.3)		-	5278×2377 (207.8×93.6)		-
		with rear chip conveyor	mm (inch)	2830×2969 (111.4×116.9)		3900×2969 (153.5×116.9)	3455×3399 (136.0×133.8)		4130×3399 (162.6×133.8)	5000×3855 (196.9×151.8)		5000×3855 (196.9×151.8)
	Machine weight (exclude stocker and chip conveyor)		kg (lb)	4100 (9038.8)			5800 (12786.6)			9000 (19841.3)		

{ } : Option

QL series

Standard Feature

- Turn Over
- Coolant Tank & Pump
- Air Blower for Chuck (Air Blaster)
- Protect Cover
- Top Door
- Hydraulic Pump
- Work Light
- Level Bolt & Plate
- MPG
- 3 Color Signal Tower
- Chuck Clamp Detection
- Gantry loader type
- Coolant pump for main turret
- Signal tower
- Gantry top door
- Tool post (hydraulic type)
- Work light

Optional Feature

- Soft jaw
- Hard jaw
- Stocker
- Inspection chute
- Flushing coolant
- TSC (coolant/air)
- Oil skimmer
- Coolant pressure S/W
- Chuck coonat (coolant blaster)
- Coolant gun
- Air gun
- Chip conveyor
- Chip bucket
- Mist collector
- Tool setter (removable)
- Work locating confirmation (air limit sensing)
- Auto power off
- Gantry loader stocker
- Chute for workpiece inspection
- TSC for main/left spindle
- Chip conveyor type
- Chuck clamp confirmation
- Electric power transformer
- Air conditioner
- Electric cabinet light
- Electric line filter
- Work & tool counter
- Extra M code
- Shunt trip coil
- Doosan tool monitoring system
- High coolant interface

- The specifications and information above-mentioned may be changed without prior notice.
- For more details, please contact Doosan.

NC Unit Specifications

Fanuc i series

AXES CONTROL

- Controlled axes	4 [X, Z+X, Z] axes
- Simultaneous controlled axes	4 [2+2] axes
- Backlash compensation	0 ~ ±9999 pulses
- Backlash compensation for each rapid traverse and cutting feed	
- Chamfering on/off	
- Emergency stop	
- Fine Acc & Dec control	
- Follow-up	
- HRV2 control	
- Inch / Metric conversion	
- Increment system 1/10	0.0001 / 0.00001 mm/inch
- Interlock	All axis / each axis
- Least input command	0.001 / 0.0001 mm/inch
- Machine lock	All axis / each axis
- Mirror image	
- Overtravel	
- Position switch	
- Servo off	
- Stored stroke check 1	
- Stroke limit check before move	
- Unexpected disturbance torque detection function	

OPERATION

- Automatic operation (memory)	
- Buffer register	
- DNC operation (Reader/puncher interface is required)	
- Dry run	
- Handle incremental feed	X1, X10, X100
- Manual handle interruption	
- JOG feed	
- Manual handle feed	1 unit
- Manual intervention and return	
- Manual pulse generator	1 ea
- Manual reference position return	
- Program number search	
- Program restart	
- Sequence number search	

INTERPOLATION FUNCTIONS

- 1st. reference position return	Manual, G28
- 2nd. reference position return	G30
- Continuous thread	
- Dwell (per sec)	G04
- High speed skip	
- Linear interpolation	G01
- Multiple threading	
- Positioning	G00
- Reference position return check	G27
- Thread cutting / Synchronous cutting	
- Thread cutting retract	
- Torque limit skip	
- Variable lead threading	

FEED FUNCTION

- Automatic acceleration / deceleration	
- Cutting feedrate clamp	
- Feed per minute	
- Feed per revolution	
- Feedrate override (10% unit)	0 - 200 %
- Jog feed override (10% unit)	0 - 2000 mm/min
- Manual per revolution feed	
- Override cancel	
- Rapid traverse override	F0, 50, 100 %
- Tangential speed constant control	

AUXILIARY / SPINDLE SPEED FUNCTION

- Spindle orientation	
- Actual spindle speed output	
- Auxiliary function lock	
- Constant surface speed control	
- High speed M/S/T interface	
- M - code function	M3 digits
- S - code function	S4 / S5 digits
- Spindle serial output	S4 / S5 digits
- Spindle speed override	0 - 150 %

PROGRAM INPUT

- Absolute / incremental programming	
- Addition of custom macro common variables	
- Automatic coordinate system setting	
- Canned cycle for drilling	
- Canned cycle for turning	
- Circular interpolation by R programming	
- Control in/out	
- Coordinate system setting	G50
- Coordinate system shift	
- Custom macro	
- Decimal point programming	
- Diameter/radius programming (X axis)	
- Direct drawing dimension programming	
- G code system A/B/C	
- Input unit 10 time multiply	
- Label skip	
- Manual absolute on and off	
- Maximum program dimension	±9 digit
- Multiple repetitive canned cycle II	
- Optional block skip	9 piece
- Parity check	
- Plane selection	G17, G18, G19
- Program number	O4 digit
- Program stop / end (M00, M01 / M02, M30)	
- Programmable data input	G10
- Sequence number	N5 digit
- SUB program call	4 folds nested
- Tape code : ISO / EIA auto recognition	EIA RS422 / ISO840
- Tape format for FANUC Series 15	
- Work coordinate system	G52 - G59

TOOL FUNCTION / TOOL COMPENSATION

- Automatic tool offset	
- Direct input of offset value measured B	
- T-code function	T2+2 digits
- Tool geometry / wear compensation	
- Tool life management	
- Tool nose radius compensation	
- Tool offset	G43, G44, G49
- Tool offset pairs	64 pairs

EDITING OPERATION

- Back ground editing	
- Extended part program editing	
- Number of registered programs	400 ea
- Part program editing	
- Part program storage length	1280 m
- Play back	
- Program protect	

SETTING AND DISPLAY

- Actual cutting feedrate display	
- Alarm display	
- Alarm history display	
- Current position display	
- Directory display and punch for each group	
- Directory display of floppy cassette	
- Display of spindle speed and T code at all screens	
- External message display	
- Help function	
- Multi-language display	
- Operation history display	
- Parameter setting and display	
- Program name display	31 characters
- Run hours / part count display	
- Self-diagnosis function	
- Servo setting screen	
- Spindle setting screen	
- Status display	

DATA INPUT / OUTPUT

- External data input	
- External key input	
- External program input	
- External program number search	
- External work number search	
- Memory card input/output	
- Reader/puncher interface	CH1. interface
- RS232C interface	

OTHER

- Cycle start and lamp	
- Display unit	10.4" Color LCD/MDI
- Feed hold and lamp	
- NC and servo ready	
- PMC system	PMC-SB7
- EZ guide i (Conversational programming solution)	
- Ethernet function	

NC Unit Specifications

Fanuc 31i

AXES CONTROL

- Controlled path of HT230T/H250T/ H250TM/H310T/H310TM	2 path
- Controlled path of HT230TG/QL200H/ QL200HM/QL300H/QL300HM	2+1 path
- Controlled axes of HT230T/H250T/H310T/ HT230TG/QL200H/Q300H	4 [2+2] axes
- Controlled axes of H250TM/H310TM/ QL200HM/QL300HM	8 [4+4] axes
- Simultaneous Controlled axes of HT230T/H250T/ H310T/HT230TG/QL200H/Q300H	4 [2+2] axes
- Simultaneous Controlled axes of H250TM/ H310TM/QL200HM/QL300HM	6 [3+3] axes
- Axis control by PMC	
- Backlash compensation	0 ~ ±9999 pulses
- Backlash compensation for each rapid traverse and cutting feed	
- Position switch	
- Chamfering on/off	
- Emergency stop	
- Fine Acc & Dec control	
- Follow-up	
- High speed HRV control	
- HRV2 control	
- Inch / Metric conversion	
- Interlock	All axis / each axis
- Least input command	0.001 / 0.0001 mm/inch
- Machine lock	All axis / each axis
- Mirror image	
- Overtravel	
- Servo off	
- Stored stroke check 1	
- Unexpected disturbance torque detection function	

OPERATION

- Automatic operation (memory)	
- Buffer register	
- Dry run	
- Handle incremental feed	X1, X10, X100
- JOG feed	
- Manual intervention and return	
- Manual pulse generator	1 ea
- Manual reference position return	
- MDI operation	
- Program number search	
- Sequence number search	
- Single block	

INTERPOLATION FUNCTIONS

- 1st. reference position return	Manual, G28
- 2nd. reference position return	G30
- Circular interpolation	G02
- Continuous threading	
- Dwell (per sec)	G04
- Linear interpolation	G01
- Multiple threading	
- Reference position return check	G27
- Skip	G31
- Thread cutting / Synchronous cutting	
- Thread cutting retract	
- Torque limit skip	

FEED FUNCTION

- Automatic acceleration / deceleration	
- Cutting feedrate clamp	
- Feed per minute	
- Feed per revolution	
- Feedrate override (10% unit)	0 - 200 %
- Jog feed override (10% unit)	0 - 2000 mm/min
- Manual per revolution feed	
- Override cancel	
- Rapid traverse override	F0, 25, 100 %
- Rapid traverse rate	
- Tangential speed constant control	

AUXILIARY / SPINDLE SPEED FUNCTION

- Spindle orientation	
- Auxiliary function lock	
- Constant surface speed control	G96
- M - code function	M3 digits
- Rigid tapping	
- S - code function	S4 / S5 digits
- Spindle serial output	S4 / S5 digits
- Spindle speed override	0 - 150 %

PROGRAM INPUT

- Absolute / incremental programming	
- Automatic coordinate system setting	
- Canned cycle for drilling	
- Canned cycle for turning	
- Circular interpolation by R programming	
- Control in/out	
- Coordinate system setting	G50
- Coordinate system shift	
- Custom macro	
- Macro executor	
- Decimal point programming / pocket calculator type decimal point programming	
- Diameter/radius programming (X axis)	
- Direct drawing dimension programming	
- Direct input of coordinate system shift	
- G code system A	
- Input unit 10 time multiply	
- Label skip	
- Manual absolute on and off	
- Maximum program dimension	±9 digit
- Multiple repetitive canned cycle	G70 - G76
- Multiple repetitive canned cycle II	
- Optional block skip	9 piece
- Parity check	
- Plane selection	G17, G18, G19
- Program number	O4 digit
- Program stop / end (M00, M01 / M02, M30)	
- Programmable data input	G10
- Sequence number	N5 digit
- SUB program call	10 folds nested
- Tape code : ISO / EIA auto recognition	EIA RS422 / ISO840
- Work coordinate system	G52 - G59

TOOL FUNCTION / TOOL COMPENSATION

- Automatic tool offset	
- Direct input of offset value measured	
- Direct input of offset value measured B	
- T-code function	T2+2 digits
- Tool geometry / wear compensation	
- Tool life management	
- Tool nose radius compensation	
- Tool offset	G43, G44, G49
- Tool offset pairs	±6 digits : 64 pairs
- Tool offset value counter input	

EDITING OPERATION

- Back ground editing	
- Extended part program editing	
- Number of registered programs	500 ea
- Part program editing	
- Part program storage length	640 m
- Program protect	

SETTING AND DISPLAY

- Actual cutting feedrate display	
- Alarm display	
- Alarm history display	
- Current position display	
- Display of spindle speed and T code at all screens	
- Help function	
- Multi-language display	
- Operation history display	
- Parameter setting and display	
- Run hours / part count display	
- Self-diagnosis function	
- Servo setting screen	
- Spindle setting screen	
- Status display	

DATA INPUT / OUTPUT

- External key input	
- External work number search	15 points
- Memory card input/output	
- Reader/puncher interface	CH1. interface
- RS232C interface	

OTHER

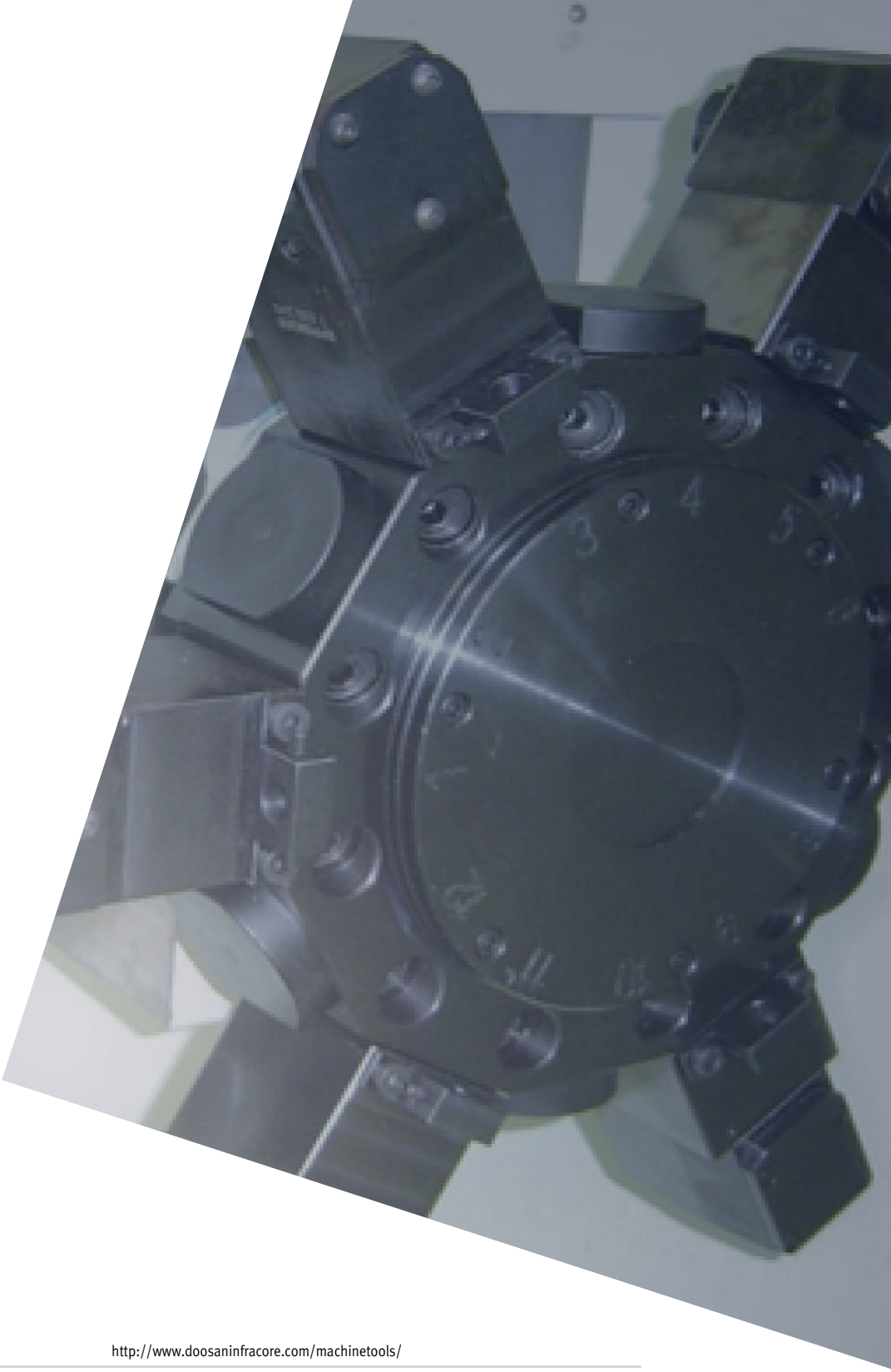
- Cycle start and lamp	
- Display unit	10.4" Color TFT LCD
- Feed hold and lamp	
- NC and servo ready	
- PMC system	
- Reset / rewind	

INTERFACE FUNCTION

- Ethernet function	Embedded ethernet

OPTIONAL SPECIFICATIONS

- Controlled axes expansion (Total)	Max.8 [4+4] axes
- Stored stroke 2 and 3	
- DNC operation (Reader / puncher interface is required)	
- Manual handle feed	2 units
- Manual handle interruption	
- Reference position shift	
- Tool retract and recover	
- 3rd / 4th reference point return	
- Circular threading	
- Multi step skip	
- Variable lead threading	
- Advanced preview control	
- External deceleration	
- Feed forward function	
- Feed stop	
- Addition of workpiece coordinate system pair	48 pairs
- Optional block skip (soft operator's panel)	9 piece
- Pattern data input	
- Work coordinate system preset	
- Addition of tool pairs for tool life management	128 pairs
- Tool load monitoring system	
- Tool offset pairs	64 / 99 / 200 / 400 / 999 / 2000 pairs
- Number of registered programs & Part program storage length	1280 M (512KB) - 1000 ea 2560 M (1MB) - 1000 ea 5120 M (2MB) - 1000 ea 10240 M (8MB) - 1000 ea 20480 M (8MB) - 1000 ea 2560 M (1MB) - 2000 ea 5120 M (2MB) - 4000 ea 10240 M (4MB) - 4000 ea 20480 M (8MB) - 4000 ea
- Play back	
- Directory display of floppy cassette	



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